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The First Instar Larvae of the Heliconiinae (Butterflies) of Trinidad, W. I.[1, 2]

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(Text-figures 1-5)

CONTENTS

[This paper is one of a series emanating from the tropical Field Station of the New York Zoological Society, at Simla, Arima Valley, Trinidad, West Indies. This station was founded in 1950 by the Zoological Society's Department of Tropical Research, under the direction of Dr. William Beebe. It comprises 200 acres in the middle of the Northern Range, which includes large stretches of undisturbed government forest reserves. The laboratory of the station is intended for research in tropical ecology and in animal behavior. The altitude of the research area is 500 to 1,800 feet, with an annual rainfall of more than 100 inches.

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[2] This study has been completed with the aid of National Science Grant G6376.

[For further ecological details of meteorology and biotic zones see "Introduction to the Ecology of the Arima Valley, Trinidad, B.W.I.," William Beebe, Zoologica, 1952, Vol. 37, No. 13, pp. 157-184].

INTRODUCTION

THE purpose of this paper is to describe the first instar larvae of 14 species of Heliconiinae distributed in Trinidad, W. I. It is hoped that salient diagnostic characters have been found that will lay the basis for future descriptions in the Heliconiinae. Since the first instar larva of a species represents an ancestral condition and the least adaptive larval instar, the present work may aid in the framing of a more natural classification when a sufficient number of descriptions of Heliconiinae and related Nymphalidae are assembled. Previous descriptions of the first instar larvae of the Heliconiinae were written before the study of chaetotaxy had been developed and also before the modern stereoscopic microscope and illuminators were available.

It would be premature to make any systematic changes on the basis of the present study, no matter how provocative some of the findings are, since the present material represents but a fraction of the approximately 500 forms described in the Heliconiinae and the first instar larvae are only one phase of the biological picture. However, it may be pointed out that on the basis of the chaetotaxy of the first instar larvae there is as much or greater evidence for the erection of separate taxa for *Heliconius doris* and *H. wallacei* than there is for separating *Heliconius aliphera* and *ricini*, as is done at the present time. There is also evidence of a close relationship in *Heliconius* species that are at present widely separated on the basis of characters of the imago.

The position of the setae of the prothorax has been figured for each species because of the strong possibility that the relative position of the subdorsal and lateral setal groups in particular may have phylogenetic significance. The same thought has prompted the figures of the crochets for each of the species. It seems likely that the species having the most incomplete circles of crochets on the anal proleg are more advanced than those with a nearly complete circle. The enlargement of some crochets suggests a stage in the development of a uniserial condition.

While Trinidad is insular, it has a relatively large heliconiine fauna. Nine species representing the three subgenera in the genus *Heliconius* were obtained, as well as a representative species of five additional genera. Only one genus, *Podotricha* Michener (1942a), was unavailable.

The illustrations are the patient and careful work of two artists. All the text-figures were drawn by Julie C. Emsley except 4I and 5I which were drawn by Frances Waite Gibson.

The responsibility for the emergence of the larvae from the eggs was assumed at different times by Susan Alan, Constance Carter, Frances Waite Gibson, Rosemary Kenedy, Jane S. Kinne and Barbara Young.

Other organizations and individuals that made this study possible are the Alcoa Steamship Co., Mrs. Mabel Ingalls and Mr. Kurt Reisinger.

My thanks also go to Dr. William Beebe and Jocelyn Crane for advice and criticism in the various phases in the preparation of this paper.

External Morphology

While the external morphology of lepidopterous larvae is more uniform than that in other orders of holometabolous insects, the terminology applied to many of the structures is varied. In this and the following section on chaetotaxy I have given the important synonyms likely to be encountered and the author and publication in which the terms have been used. Since this paper is descriptive, I have endeavored to use the commonest and simplest structural terms available.

Head.—The head when viewed from the front consists of two hemispheres separated anteriorly by a triangular plate. Each of the hemispheres can be called an epicranium (Forbes, 1910, 1923, and other papers). The epicrania are the parietal lobes of Snodgrass (1935, 1947). The triangular area between the epicrania is here named the front. It is the clypeus of Snodgrass (1935, 1947) and the frontoclypeal apotome of Hinton (1947). In the first instar only one suture is present between the front and the epicrania, which is here called the frontal suture (lateral adfrontal suture, Hinton, 1947). At the apical area of the head each of the frontal sutures converges to form the epicranial stem. This is the coronal stem of authors and the median adfrontal suture of Hinton (1947). On the anterior edge of the front is the clypeus, and the movable organ below the clypeus is the labrum. Below the labrum are the mandibles. Cephalad of the most anterior ocelli (ocellus 5) and approximately on the level with the base of the mandibles are the antennae. Beneath the mandibles are the maxillae. A hypopharynx lies between the maxillae and from the distal end projects the spinneret with labial palpi on each side. Six ocelli are present on the anterior lateral part of the epicranium, arranged in a rough semicircle. They are numbered one to six, starting with the most dorsal and posterior ocellus and proceeding anteriorly.

Thorax.—The thorax consists of three segments with one pair of true legs to a segment. Each leg is composed of a coxa, femur, tibia, tarsus and claw. I have been unable to observe a trochanter in the first instar. On the dorsum of the prothorax is the prothoracic shield (cervical shield of authors) and laterally on the same segment a spiracle, the mesothoracic spiracle.

Abdomen.—The abdomen is divided into ten segments. The third, fourth, fifth and sixth segments bear the ventral prolegs and the tenth the anal prolegs. On the dorsum of the tenth or anal segment there is an anal plate. On the distal end of each proleg is a planta to which the crochets are attached. In the first instar larvae of the Heliconiinae the crochets of the ventral prolegs form uniserial, uniordinal complete circles. The crochets on the anal prolegs are variously incomplete uniserial, uniordinal mesopenellipses. The crochets of different species differ in the number of crochets on the planta and most often also in having several of the crochets longer than others. The most mesal crochets of the ventral prolegs and the anal prolegs are usually longer.

Chaetotaxy

The terminology of Hinton (1946) has been employed in this paper. Various other systems or modifications of existing systems have been in use, notably Dyar (1894), Quail (1904), Fracker (1915), Heinrich (1916, 1918, 1921), Forbes (1910, 1914, 1916), Ripley (1923) and Gerasimov (1935, 1937, 1952). Hinton (1946) and McGuffin (1958) have presented tables comparing a number of the various systems.

The head of Heliconiinae larvae lacks the vertical and the genal groups of minute cranial

setae in all of the species studied. The number of cranial punctures or pores has also been reduced. Only puncture Fa, which is quite distinct, has been observed.

Thus, of the four (rarely five) minute setae and eight basic punctures considered to be generally present in Lepidoptera, no minute setae and only one puncture are present. On the other hand, all of the twelve long setae which usually occur on lepidopterous larval hemispheres are present, along with the five setae customarily on the front, adfrontal and clypeus. Various other setae are present on the ventrum of the head, associated with such structures as the postmentum and basal regions of the maxillae, but these appear to be of no taxonomic importance in Lepidoptera and have not been named. In the first instar the setae on the labrum do not appear to vary among the genera and species of Heliconiinae. The important cranial setae are illustrated in Text-figs. 1 and 2.

Clypeal setae (Heinrich, Ep. 1, 2; Ripley, C2, 1; Gerasimov, C11, 12). Seta C1 is near the cephalad ventral corner of the clypeus and seta C2 mesad and caudad of seta C1. Both setae are subequal.

Frontal seta (Heinrich, Fr. 1; Ripley, F1; Gerasimov, F1). Seta F1 rises from slightly nearer the base angles of the clypeus than to the apical angle of the front. Seta F1 may be smaller, equal to, or greater in length than setae C1 and C2, but it is always one of the shortest setae of the head.

Adfrontal setae (Heinrich, Adf. 1, 2; Ripley, A2, 1; Gerasimov, Fr. 1.1, 1.2). Setae AF1 and AF2 are most often slightly shorter than the clypeal setae. Seta AF1 rises approximately half-way between Seta F1 and the apex of the triangular front along the lateral side of the frontal suture. Seta AF2 rises approximately the same distance from the epicranial suture as from the frontal suture.

Anterior setae (Heinrich, Ad-1, 2, 3; Ripley, V9, 8, 4; Gerasimov, A1, 2, 3). Seta A1 is dorsal of the ocelli and just above the base of the antenna. Seta A2 lies caudad of seta A1 and nearer the frontal suture. Seta A3 is caudad and laterad of seta A2. Seta A3 is the longest seta of the anterior setal group and seta A2 is the shortest or subequal with seta A1.

Ocellar setae (Heinrich, O-3, 2, 1; Ripley, V7, 5, 6; Gerasimov, O1, 2, 3). Seta O1 is enclosed within the pseudocircle formed by the ocelli. Seta O2 is outside the ocellar circle and caudad and dorsad of seta O1. Seta O3 is caudad and ventrad of setae O1 and O2. Setae O2 is the longest seta of the ocellar group except in *Heliconius wallacei* in which seta O3 is the longest. Seta O3 is usually slightly longer than seta O1 but not infrequently subequal.

Subocellar setae (Heinrich, SO-1, 2, 3; Ripley, V11, 12, 10; Gerasimov, SO1, 2, 3,) Seta SO1 lies below the antenna, near the base of the maxilla. It is very slender and often difficult to discern. Seta SO2 lies below ocellus 5 and nearer the antennal base than to ocellus 5. Seta SO3 lies on a line or just outside a line drawn between ocellus 5 and ocellus 6. Seta SO2 is the longest seta of the subocellar group.

Lateral seta (Heinrich, L-1; Ripley, V3; Gerasimov, L1). The lateral seta L1 is dorsad of ocellus 1 and approximately the same distance from ocellus 1 as from the caudal margin of the epicranium. It is laterad of seta P2. Seta L1 is approximately twice as far from the caudal margin of the epicranium as seta O3. It is usually much longer than seta O3 but is subequal in *Heliconius numata* and shorter in *Heliconius wallacei.*

Posterior setae (Heinrich, Pd-1; Ripley, V2, 1; Gerasimov, P1, 2). Seta P1 is on the vertex of the head near the anterior end of the epicranial stem and seta P2 is caudad of seta P1. Setae P1 and P2 are the longest setae of the head. These two setae vary among the species of Heliconiinae from Trinidad in the distance of each from the epicranial stem.

No microscopic setae or proprioceptors have been observed on the thorax or abdomen of the Heliconiinae studied. Neither have any punctures been seen on the prothoracic plate except one, provisionally named XDc, in one species, *Dryas iulia.*

XD group (Fracker, alpha, gamma; Gerasimov, X, IX). The Heliconiinae in this paper are unusual among Lepidoptera in having only seta XD2 present on the prothorax. There is no suggestion on the prothoracic plate of even an aborted seta XD1. In most of the species discussed, seta XD2 is shorter than seta D1, but in *Agraulis vanillae* and *Heliconius isabella* the two setae are subequal. Seta XD2 is longer than seta D2 except in *Philaethria dido* and *Heliconius aliphera* where the setae are subequal and in *Heliconius numata* and *Heliconius sara* where seta XD2 is shorter than seta D2.

Dorsal group (Fracker, alpha, beta; Gerasimov, I, II). Setae D1 and D2 are present on all the thoracic and abdominal segments. Seta D1 is always anterior dorsad of seta D2 and is the longest seta on the thorax and abdominal segments 1-8 except in *Heliconius wallacei* where the two setae are subequal on the prothorax. On the ninth abdominal segment of *Heliconius*

isabella seta D1 and seta D2 are subequal in length, and in *Heliconius wallacei* seta D2 is longer than seta D1. In the remaining species seta D1 is longer than seta D2 on the ninth abdominal segment.

Subdorsal group (Fracker, rho, epsilon; Gerasimov, III, IIIa). Whereas setae D1 and D2 are each on a separate pinaculum except on the prothoracic plate where they are associated with XD2, setae SD1 and SD2 are on the same pinaculum. The subdorsal group is bisetose on the thorax and unisetose on the abdominal segments. On the prothorax seta SD1 is usually distinctly dorsad and cephalad of seta SD2. However, the relative positions of these two setae, while subtle and difficult to describe, are of diagnostic importance. For instance, in *Heliconius ricini* seta SD1 is only slightly dorsad of seta SD2 but very noticeably cephalad, while in *Heliconius aliphera* seta SD1 is almost directly dorsad of seta SD2 and but slightly cephalad. Seta SD1 is a long, stout seta rivaling seta D1 in size. Seta SD2 is always very slender regardless of its length. On the ninth abdominal segment seta SD1 is always shorter in length than either seta D1 or seta D2.

Lateral group (Fracker, kappa, eta, theta on the thorax and kappa, eta, mu on the abdomen; Gerasimov, IV, V, VI). With one exception, *Heliconius ricini,* both setae L1 and L2 are present on the prothorax and on the same pinaculum. Seta L2 is absent on the meso- and metathorax. Both setae L1 and L2 are present on the abdominal segments on separate pinacula except on the ninth segment where only seta L1 is present. On the prothorax seta L1 is ventrad of seta L2 as well as longer and much thicker. Setae L1 and L2 vary in their relative position to one another in the same manner as the subdorsal setae (see Text-fig. 4). Seta L1 is approximately on the same level as the spiracle, and seta L2 is above the spiracle. Seta L1 on the meso- and metathorax is below the level of the spiracle on the prothorax and also longer than seta L1 on the prothorax. Seta L1 is slightly below the level of the spiracle on the abdominal segments and seta L2 is ventrad and cephalad of seta L1. Seta L2 is more or less directly below the spiracle. Seta L1 on the ninth segment is very short and thick but on approximately the same level as seta L1 on the eighth segment.

On abdominal segments 1-8 inclusive in two species, *Heliconius aliphera* and *wallacei,* an additional seta of the lateral group is present. I have called this seta L3 and it is cephalad and dorsad of seta L2 and on the same pinaculum. It is doubtful, however, that this seta is seta L3 of other Lepidoptera. First of all, seta L3 is a subprimary seta on the abdomen of other Lepidoptera. Secondly, in some species of *H. wallacei* an occasional adventitious seta will appear on the pinaculum of seta L2, making a total of three setae on the same pinaculum. This additional seta may appear on any of the first eight abdominal segments, but in the specimens seen only on one or the other side of the larva. This additional seta may represent a stage in development or loss of a verruca in Lepidoptera. Seta L3 probably should be considered as a secondary seta present in the first instar larvae.

Subventral group (Fracker, pi, nu, tau; Gerasimov, VIIa, VIIb, VIIIc). Setae SV1 and SV2 are present on the same pinaculum on the prothorax. Seta SV2 is anterodorsad of seta SV1 and much shorter and thinner. The subventral pinaculum is directly below the subdorsal pinaculum and thus somewhat caudad of the lateral pinaculum. It lies approximately midway between the spiracle and the base of the proleg. In one species, *H. wallacei,* an additional seta named SV3, is present. This must be a secondary seta similar to seta L3 discussed under the lateral group. In most species only seta SV1 is present on the meso- and metathorax. In *Dione juno* and *Heliconius doris* seta SV2 is present as a very slender seta but is not necessarily shorter than seta SV1. Only *Heliconius wallacei* has seta SV2 present on the first abdominal segment. Both setae SV1 and SV2 are present on abdominal segments 2-6 inclusive in all of the species studied. Only seta SV1 is present on abdominal segments 7, 8 and 9.

Ventral group (Fracker, sigma; Gerasimov, VIII). Seta V1 is absent on the three thoracic segments. There are three to five coxal setae distributed on the anterior, mesal and posterior sides of the coxae. Seta V1 is present on the first and second abdominal segments very near the medio-ventral line and on the mesal side of the ventral prolegs. It is always a very short, fine seta. It is absent on abdominal segments 7, 8 and 9 but present on the 10th.

Methods and Diagnostic Characters

The equipment used consisted of a stereoscopic microscope with a magnification of 112 diameters and a very strong light. Two microscopic illuminators were frequently used simultaneously. An ocular micrometer was used for all measurements. A dissecting needle was used to manipulate the larvae into suitable positions. A small amount of cotton in a watch glass was found most useful to support the larvae in various unnatural positions. All larvae were studied in 70 percent. alcohol.

It was found to be particularly important

when measuring the setae to be sure that they were silhouetted against the background and that all parts were in the plane of focus. Unless this is done very discrepant measurements will result. When measuring the distance between various setae of the head, the curvature of the head was ignored, but the specimen was adjusted under the microscope so that the base of each seta was equally in focus. This was usually equivalent to having the mid-point between any two setae or the mid-point of a suture in the center of the microscopic field.

A 10% solution of potassium hydroxide was useful in clearing the head specimens. Clearing was rarely of any value in rendering the setae more visible but was helpful in determining the absence of certain punctures of the head.

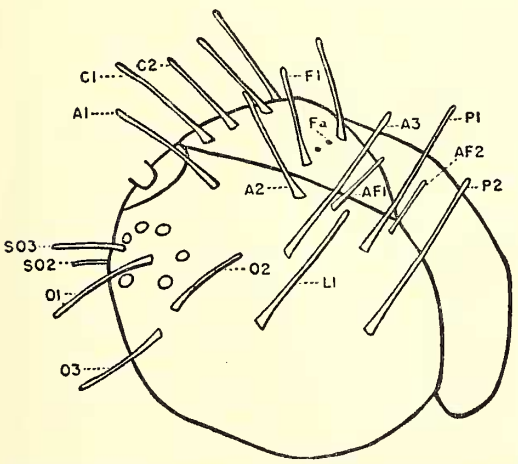
The width of the head was always determined at its widest points. A frontal or dorsal view gave the same measurements. Text-figs. 1 & 2 will orient the setae and other structures of the Heliconiinae. The setae of the body are illustrated in Text-figs. 3a and 3b. The coxal setae have been omitted from the pro- and mesothoracic figures, as no reference is made to them in the tables or descriptions. The prothoracic plate and pinacula in the setal figures have been stylized as the outline of these structures varies between individuals and has no taxonomic significance.

The chaetotaxy of the last abdominal segment has been ignored, as no significant characters have been found, and the homologies of the setae have not been resolved. The tables show the lengths in microns of the setae of one specimen of each species. In the majority of species five or six specimens have been seen. The lengths of the setae of the head appear to vary only minutely between different specimens. The length of the body setae XD2, D1, D2, SD1, L1 and SV1 varies approximately 10 percent. The remaining setae of the body, which are the fine setae, often vary much more. Thus, the unit measurements are much less reliable than the relative size of the setae. For instance, in *Agraulis vanillae* and *Heliconius numata* it may be stated that setae XD2 and D1 are subequal, but that in the remainder of the species studied seta D1 is longer than seta XD2. On the other hand it can not be stated that seta D1 is a certain number of microns longer than any other seta inter- or intraspecifically. For this reason a percentage has been given in Table 1 comparing the length of the setae of the head relative to the width of the head, but no percentage is given for the body setae.

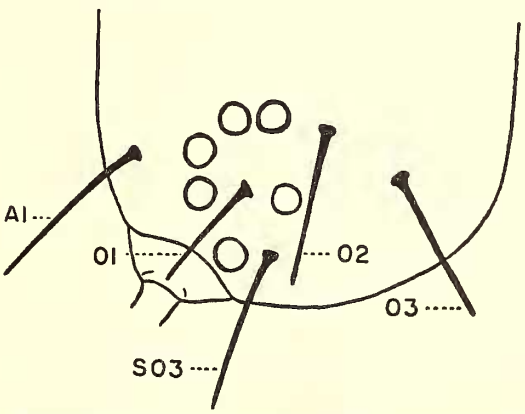
The accuracy of measurements is within seven microns. In the ocular micrometer used the smallest unit distance was equivalent to 13⅓ microns at 112 diameter magnification. The author felt capable of determining no smaller division than half of the smallest micrometer unit. Thus, any setae not differing by more than 13 or 14 microns are considered subequal, for between the variations of the larvae and the author's limitations any smaller distance is meaningless.

The descriptions following the species summarize and give salient characters from the tables and text-figures. The tables should be referred to for more complete details.

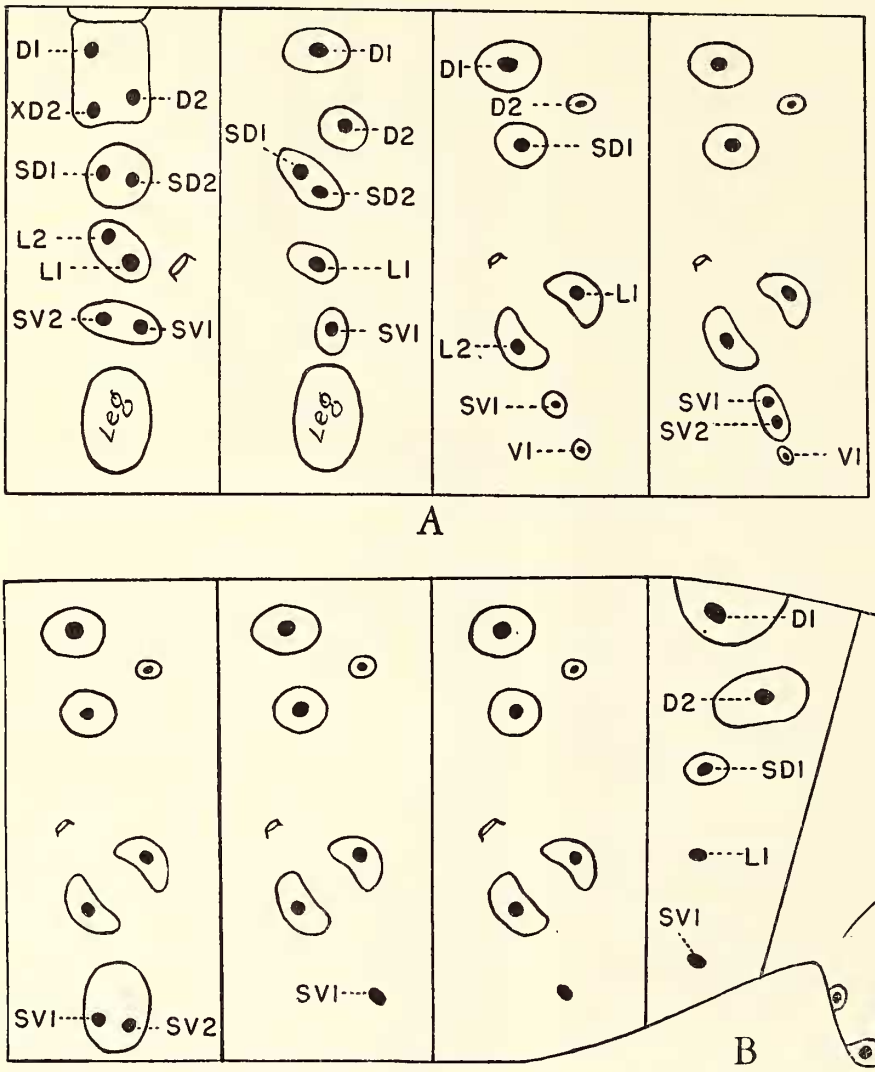
Papers other than those mentioned in the text which are of assistance on larval morphology or chaetotaxy are Crumb (1934), Dampf (1910), Dyar (1896), Ferris (1943), Garman (1921), Hinton (1952), Müller (1886), Peter-



TEXT-FIG. 1. Chaetotaxy of the head of *Heliconius melpomene.*



TEXT-FIG. 2. Chaetotaxy of head in ocular area of *Heliconius melpomene.*



TEXT-FIG. 3. Chaetotaxy of body of *Heliconius melpomene*. **A**. Chaetotaxy of prothorax, mesothorax, first and second abdominal segments. **B**. Chaetotaxy of 6th to 10th abdominal segments.

son (1948), Schierbeek (1917) and Tsou (1914).

Reference should be made to "A Comparison of Eggs, Larvae and Pupae in Fourteen Species of Heliconiine Butterflies from Trinidad, W.I." by Beebe, Crane & Fleming (Zoologica, 45:111) for color notes and larval lengths of living specimens of first instar larvae.

CLASSIFICATION

The species discussed in this paper have been treated as a subfamily for convenience and not because the present study has determined any phylogenetic homogeneity with or proportion of morphological differences from other nymphalid relatives. The generic revision of Heliconiinae by Michener (1942a) has been followed. Three species, *Heliconius melpomene*, *H. wallacei* and *H. doris*, from Surinam, have been studied and do not vary from the Trinidad larvae of the same species. All species treated in this paper are nominate subspecies except for *Heliconius melpomene euryades* (Riffarth), *H numata ethilla* Godart, *H. erato hydara* Hewitson, *H. ricini insulana* Stichel and *H. sara thamar* (Hübner). The only two forms restricted to Trinidad are *Heliconius melpomene euryades* and *H. ricini insulana*. The latter subspecies was not recognized by Kaye (1921) nor were the nominate subspecies designations of *Dione juno*, *Agraulis vanillae*, *Dryadula phaetusa*, *Dryas iulia* and *Philaethria dido*. Seitz (1913) was used as the

authority for these forms with the exception of *Agraulis vanillae* where Michener (1942b) was used. Michener (1942a) divided the genus *Heliconius* into three subgenera. *Heliconius isabella* is in his subgenus *Eueides*, *H. aliphera* in his subgenus *Semelia* and the remainder of the species of *Heliconius* from Trinidad in his subgenus *Heliconius*. Of the genera recognized by Michener (1942a), only one genus *Podotricha*, is absent from this paper.

Key to First Instar Larvae

1. Meso- and metathorax with two setae, SV1 and SV2, present on the same pinaculum..2
   Meso- and metathorax with only one seta, SV1, present on the subventral pinaculum.3
2. Head with epicranial stem longer than frontal suture. Seta D1 of the ninth adominal segment subequal or smaller than seta D1 of abdominal segments 3-8...*Heliconius doris*
   Head with epicranial stem shorter than frontal suture. Seta D1 of the ninth abdominal segment 7/10 longer than seta D1 of abdominal segments 3-8.....*Dione juno*
3. Seta D2 of first two abdominal segments very small; 1/10 of length of seta D1.....*Agraulis vanillae*
   Seta D2 of first two abdominal segments at least ⅓ the length of seta D1.....4
4. Abdominal segments 1-8 with three lateral setae, L1, L2, L3, and with setae L2 and L3 on the same pinaculum.....5
   Abdominal segments 1-8 with only two lateral setae, L1 and L2.....6
5. First abdominal segment with two subventral setae, SV1 and SV2. Prothorax with seta SV3 usually present though very small.....*Heliconius wallacei*
   First abdominal segment with only one subventral seta, SV1. Prothorax with seta SV3 absent.....*Heliconius aliphera*
6. Seta D2 ventrad of seta XD2 on prothorax.....*Philaethria dido*
   Seta D2 dorsad of seta XD2 on prothorax....7
7. Distance of seta P1 of head to epicranial stem greater than the distance of seta P2 to epicranial stem.....*Dryas iulia*
   Distance of seta P1 of head to epicranial stem less than the distance of seta P2 to epicranial stem.....8
8. Epicranial stem of head longer than frontal suture. Length of seta D1 of the prothorax smaller than the length of the epicranial stem.....*Dryadula phaetusa*
   Epicranial stem never longer than frontal suture. Length of seta D1 at least 1/5 longer than the length of the epicranial stem.....9
9. Seta L2 of the prothorax absent. Head narrow, approximately 350μ.....*Heliconius ricini*
   Seta L2 of prothorax present. Head wide, at least 475μ or more.....10
10. Head dark colored. Setae of body concolorous and distal end not spatulate.....*Heliconius isabella*
    Head light colored. Setae of body with distal ends light colored and spatulate.....11
11. Seta P2 of head longer than seta P1. Seta D1 of prothorax greater than twice the length of the epicranial stem of head. Seta D1 of meso- and metathorax longer than on prothorax.....*Heliconius sara*
    Seta P2 of head shorter than seta P1. Seta D1 of prothorax never more than 1½ times the length of the epicranial stem. Seta D1 of meso- and metathorax shorter than on prothorax..... 12
12. Seta D2 of abdominal segments 1-8, ⅓ to 1/6 the length of seta D1.....*Heliconius erato*
    Seta D2 of abdominal segments 1-8 equal to or greater than ½ the length of seta D1....13
13. Frontal suture of head ¼ longer than epicranial stem. Seta XD2 of prothorax longer than seta D2. Seta L2 is the second largest seta on the ninth abdominal segment.....*Heliconius melpomene*
    Frontal suture of head 1/10 longer than epicranial stem. Seta XD2 of prothorax shorter than seta D2. Seta L2 is the shortest seta on the ninth abdominal segment.....*Heliconius numata*

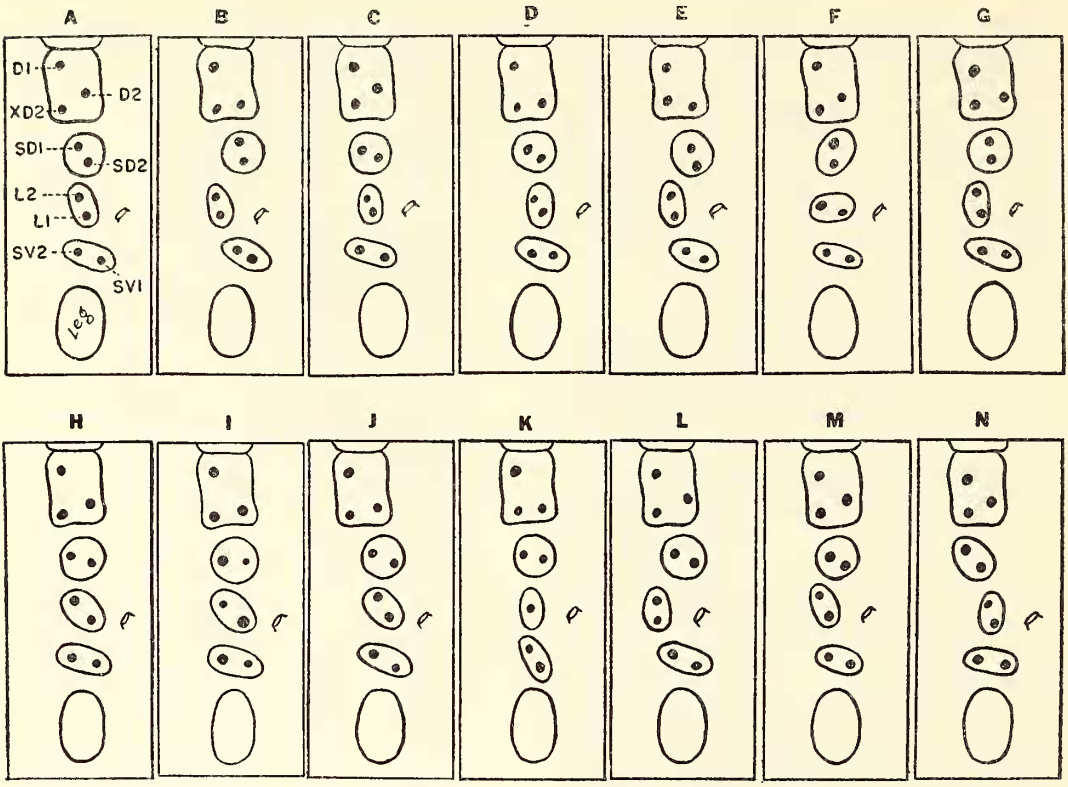
Description of the Species

Dione juno (Cramer)

(Text-figs. 4A, 5A; Tables 1-5)

Distinctive Characters.—Head medium dark colored. Hind margin of head broadly indented at dark sublateral spot. Dark hind marginal line of head touching caudal edge of head dorsally and at sublateral spot but curved cephalad subdorsally and laterally. Epicranial stem slightly longer (10%) than frontal suture. Distance of seta P2 to epicranial stem greater than the distance of seta P1 to epicranial stem. Distance between ocelli 5 and 6 greater than the distance between ocelli 4 and 5 or 4 and 6. Distance between setae P1 and P2 less than the distance between setae P1 and A3 and greater than the distance between setae A3 and L1. The distance between setae P1 and A3 less than than the distance between setae P2 and L1. Seta P1 is the longest seta and seta A3 and L1 are subequal and shorter than seta P2.

Length of seta XD2 of the prothorax approximately 3/5 the width of the head. Seta SD1 only slightly more cephalad than seta SD2. Setae L1 and L2 are similarly nearly vertical.



TEXT-FIG. 4. Chaetotaxy of prothorax of the Heliconiinae of Trinidad. **A.** *Dione juno;* **B.** *Agraulis vanillae;* **C.***Dryadula phaetusa;* **D.** *Dryas iulia;* **E.** *Philaethria dido;* **F.** *Heliconius isabella;* **G.** *Heliconius aliphera;* **H.** *Heliconius melpomene*; **I.** *Heliconius numata*; **J.** *Heliconius erato*; **K.** *Heliconius ricini*; **L.** *Heliconius sara*; **M.** *Heliconius wallacei*; **N.** *Heliconius doris.*

The lateral group is directly below the subdorsal group.

On the meso- and metathorax, seta D1 is shorter than seta SD1. Two subventral setae, SV1 and SV2, are present and originate on the same pinaculum.

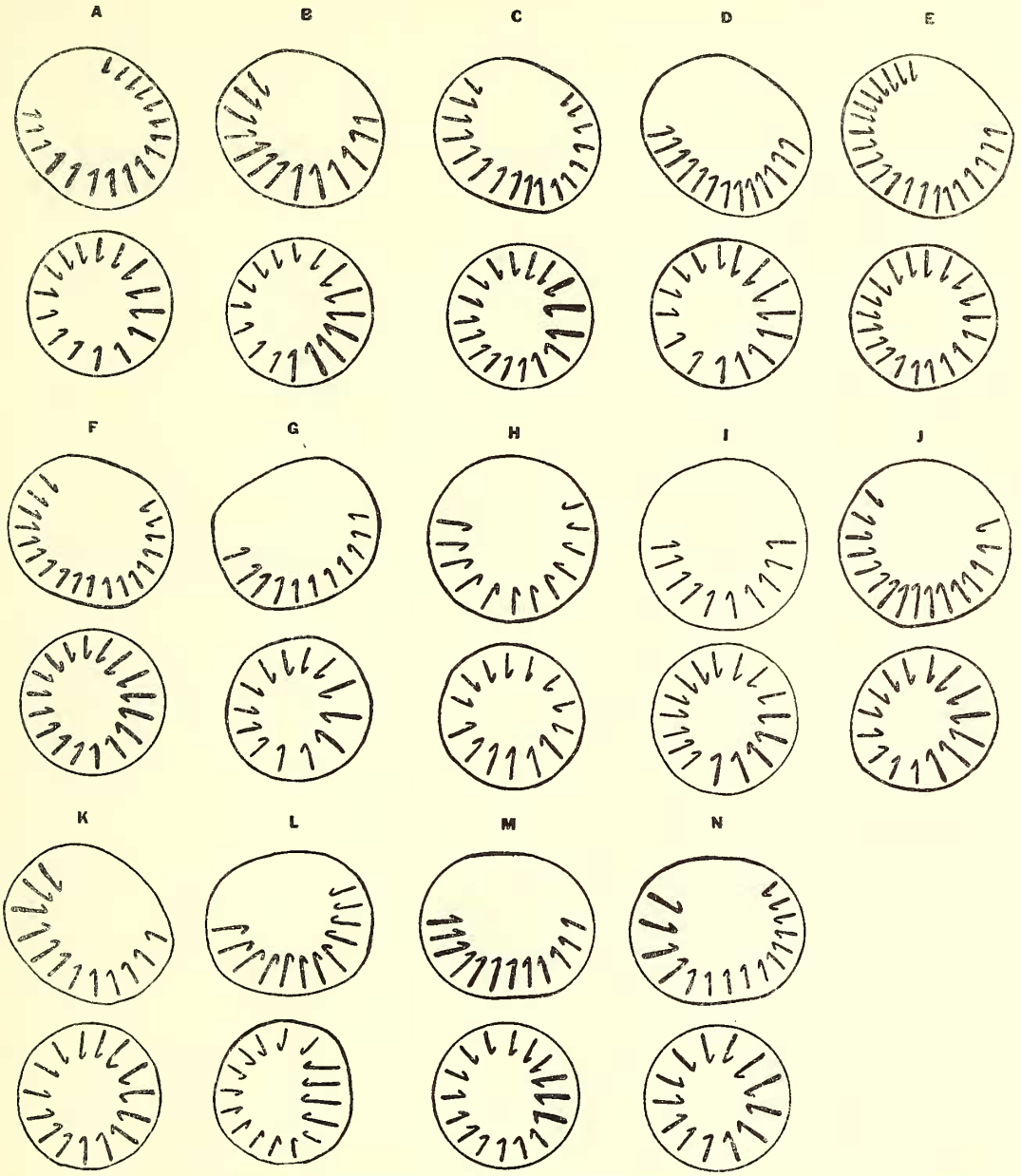
On the first and second abdominal segments, seta SD1 is longer than seta D1. On the remaining abdominal segments there is very little difference in the length between seta L1 and L2.

The size of the 15 crochets of the ventral prolegs is evenly graduated from small slender crochets to stout long crochets. On the anal prolegs 17 crochets are present and complete 7/9 of a circle.

Comparison with Other Heliconiinae of Trinidad.—Dione juno is distinctive with *Heliconius doris in* possessing two setae in the subdorsal group on the meso- and metathorax. Hinton (1946, p 34) notes that the first instar larvae of Sphingidae (*Spinx*) and Notodonidae (*Cerura*) possess seta SV2 and suggests that this seta has evolved *de novo.* Seta SV2 in *D. juno* is approximately half the length of seta SV1 while in *H. doris* the two setae are subequal. In *D. juno* the epicranial stem is longer than the frontal suture while in *H. doris* the frontal suture is the longest. In *H. doris* seta P2 is the longest seta of the head while Seta P1 is the longest in *D. juno.* In *D. juno* the respective setae of the thorax and abdomen are shorter than in *H. doris,* both in actual length and in length relative to the width of the head. On the meso- and metathorax, seta SD1 is longer than seta D1 in *D. juno* while the reverse is true in *H. doris.* On abdominal segments 3-8 of *D. juno,* the lateral setae are subequal while in *H. doris* seta L2 is much shorter than seta L1. Seta D1 of the ninth abdominal segment of *D. juno* is much longer than seta D1 of abdominal segments 3-8, while seta D1 of *H. doris* is respectively subequal or shorter.

Agraulis vanillae (Linnaeus)
(Text-figs. 4B, 5B; Tables 1-5)

Distinctive Characters.—Head very dark colored. Hind margin of head sinuate, broadly



TEXT-FIG. 5. Crochets of ventral and anal prolegs of the Heliconiinae of Trinidad. The anal proleg above ventral proleg. **A.** *Dione juno;* **B.** *Agraulis vanillae;* **C.** *Dryadula phaetusa*; **D.** *Dryas iulia*; **E.** *Philaethria dido*; **F.** *Heliconius isabella*; **G.** *Heliconius aliphera*; **H.** *Heliconius melpomene;* **I.** *Heliconius numata;* **J.** *Heliconius erato;* **K.** *Heliconius ricini;* **L.** *Heliconius sara;* **M.** *Heliconius wallacei;* **N.** *Heliconius doris.*

curved cephalad subdorsally and curved caudad sublaterally. A dark colored line on edge of hind margin of head. Frontal suture longer than epicranial stem. Distance between ocelli 4 and 5 less than the distance between ocelli 5 and 6. The distance across the ocular pseudocircle between ocelli 4 and 6 greater than the distance between ocelli 5 and 6. Seta P2 further from epicranial stem than seta P1. Distance between setae P1 and P2 less than the distance between setae P1 and A3 and greater than the distance between setae A3 and L1. The distance between setae P1 and A3 less than the distance between setae P2 and L1. Seta P1 is the longest seta on the head while setae A3 and P2 are subequal and longer than seta L1.

TABLE 1. MEASUREMENTS OF SETAE OF HEAD AND COMPARISON OF SETAL LENGTH WITH WIDTH OF HEAD IN HELICONIINAE.

Species	A1		A2		A3		O1		O2		O3		SO1		SO2		SO3		L1		P1		P2		F1		AF1		AF2		C1		C2		Width of Head
	μ*	%†	μ	%	μ	%	μ	%	μ	%	μ	%	μ	%	μ	%	μ	%	μ	%	μ	%	μ	%	μ	%	μ	%	μ	%	μ	%	μ	%	
Dione juno	147	28	107	20	200	38	67	13	147	28	67	13	67	13	107	20	67	13	200	38	333	62	267	50	93	17	67	13	67	13	120	23	120	23	533
Agraulis vanillae	133	24	80	15	187	35	80	15	93	17	80	15	107	20	160	29	107	20	147	27	267	49	187	34	67	12	67	12	67	12	107	20	107	20	547
Dryadula phaetusa	147	18	133	17	213	27	133	17	173	22	120	15	107	13	160	20	107	13	267	33	280	35	320	40	120	15	67	08	53	07	120	15	120	15	800
Dryas iulia	133	18	120	16	187	26	107	15	160	22	133	18	107	15	120	16	107	15	227	31	240	33	160	35	80	11	67	09	93	13	120	17	120	17	733
Philaethria dido	147	17	133	15	213	25	133	15	200	23	187	22	133	15	160	18	133	15	227	27	280	32	280	32	107	12	67	77	67	77	160	18	160	18	867
Heliconius isabella	107	21	107	21	173	33	53	10	107	21	93	18	40	08	80	15	40	08	160	31	227	44	213	41	67	13	80	15	80	15	67	13	67	13	520
Heliconius aliphera	133	26	133	26	240	47	93	18	200	39	93	18	80	16	93	18	80	16	173	34	280	55	213	42	93	18	67	13	53	10	67	13	67	13	507
Heliconius melpomene	133	22	120	20	227	38	107	18	147	24	120	20	107	18	133	22	107	18	187	31	307	51	253	42	107	18	80	13	53	09	120	20	120	20	600
Heliconius numata	160	27	106	18	173	29	120	20	147	25	120	20	93	16	107	18	93	16	120	20	227	38	187	31	93	15	67	11	53	09	93	15	80	13	600
Heliconius erato	133	23	107	19	173	30	93	16	133	23	107	19	107	19	133	23	107	19	133	23	240	42	200	34	93	16	53	09	93	16	93	16	93	16	573
Heliconius ricini	147	42	107	31	213	61	67	19	147	42	120	34	107	31	133	38	107	31	147	42	240	69	213	61	93	27	67	19	67	19	67	19	67	19	347
Heliconius sara	120	25	93	19	200	42	67	14	133	27	93	19	80	17	107	22	80	17	173	36	213	44	253	52	67	14	67	14	33	07	67	14	67	14	480
Heliconius wallacei	93	17	93	17	253	45	67	12	147	26	173	31	93	16	93	16	120	21	133	24	240	43	253	45	107	19	80	14	53	09	120	21	120	21	560
Heliconius doris	133	23	133	23	240	41	80	14	173	29	133	22	93	16	93	16	93	16	200	34	280	48	320	55	80	14	107	18	67	11	67	11	80	14	587

*Length of setae of head in microns. †Percentage of setal length compared with width of head.

TABLE 2. CHARACTERISTICS OF HEAD IN HELICONIINAE.

Species	Distance between Setae P1 and P2 ++		Distance between Setae P1 and A3		Distance between Setae P2 and L1 ++		Distance between Setae A3 and L1		Distance between Setae O1 and O3		Distance from Setae O3 to Hind Marginal Head		Distance between Ocelli 4 and 5		Distance between Ocelli 5 and 6		Distance between Ocelli 4 and 6		Length of Frontal Suture		Length of Epicranial Stem		Total Length of both Sutures		Distance between Seta P1 and Epicranial Stem		Distance between Seta P2 and Epicranial Stem	
	μ	%	μ	%	μ	%	μ	%	μ	%	μ	%	μ	%	μ	%	μ	%	μ	%	μ	%	μ	%	μ	%	μ	%
Dione juno	133	25	147	28	160	30	120	23	133	25	67	13	40	08	67	13	53	10	269	50	293	54	560	105	93	17	107	20
Agraulis vanillae	107	20	120	22	147	27	93	17	107	20	67	12	27	05	40	07	53	10	293	54	253	46	547	100	100	18	133	24
Dryadula phaetusa	187	23	160	20	213	27	133	17	160	20	133	17	67	08	67	08	93	12	387	48	426	53	813	102	100	12	120	15
Dryas iulia	160	21	200	28	200	28	120	16	133	18	107	15	40	05	53	07	53	07	373	51	400	55	773	105	107	15	80	11
Philaethria dido	213	25	280	32	253	29	173	20	173	20	107	12	67	07	67	07	67	07	400	47	493	57	893	103	133	15	133	15
Heliconius isabella	85	16	133	26	133	26	67	13	120	23	67	12	27	05	34	07	40	08	225	43	215	41	440	85	53	10	93	18
Heliconius aliphera	80	16	133	26	133	26	93	18	80	16	67	13	40	08	53	11	53	11	133	26	173	34	307	61	93	18	114	22
Heliconius melpomene	107	18	120	20	133	22	80	13	133	22	67	11	30	05	40	07	53	09	320	53	253	42	573	95	93	155	133	22
Heliconius numata	107	18	120	20	133	22	93	15	133	22	67	11	30	05	53	09	67	11	267	44	240	40	507	84	100	16	133	22
Heliconius erato	120	20	147	26	173	30	93	16	133	23	80	14	40	07	40	07	40	07	333	58	267	47	600	104	100	17	120	20
Heliconius ricini	120	35	120	35	147	42	67	19	67	19	53	15	13	04	13	04	40	12	307	88	240	69	547	158	100	28	133	38
Heliconius sara	93	19	120	25	133	28	80	17	120	25	53	11	27	06	27	06	67	14	253	53	200	42	453	94	67	14	80	17
Heliconius wallacei	80	14	120	21	147	26	107	19	107	19	53	09	27	05	53	09	53	09	293	52	160	29	453	81	93	17	107	19
Heliconius doris	120	20	147	25	173	29	120	20	133	23	67	11	27	05	53	09	53	09	320	55	280	47	600	102	93	16	107	18

TABLE 3. LENGTH OF SETAE (IN MICRONS) OF PROTHORAX AND MESOTHORAX IN HELICONIINAE.

Species	Prothorax										Mesothorax						
	XD2	D1	D2	SD1	SD2	L1	L2	SV1	SV2	SV3	D1	D2	SD1	SD2	L1	SV1	SV2
Dione juno	333	360	227	280	227	160	67	173	93		293	200	333	200	213	133	67
Agraulis vanillae	267	267	200	333	133	80	67	147	80		333	213	320	93	227	133	0
Dryadula phaetusa	360	400	280	320	213	133	93	160	93		360	253	400	253	320	213	0
Dryas iulia	307	373	187	347	213	160	93	173	133		360	160	333	267	280	227	0
Philaethria dido	320	400	320	293	213	133	93	187	133		360	307	307	240	267	227	0
Heliconius isabella	453	440	426	387	200	133	80	147	53		373	373	307	187	240	147	0
Heliconius aliphera	333	400	333	333	200	240	107	200	107		378	346	378	147	320	160	0
Heliconius melpomene	306	400	267	267	187	127	67	107	67		347	293	333	133	267	173	0
Heliconius numata	227	333	280	307	147	160	40	160	67		267	227	293	113	340	187	0
Heliconius erato	347	467	293	400	187	173	93	160	80		413	307	387	130	333	187	0
Heliconius ricini	253	440	200	280	93	80	0	120	40		280	240	213	93	240	107	0
Heliconius sara	320	480	467	373	160	240	133	120	93		573	546	333	160	333	80	0
Heliconius wallacei	373	427	333	320	187	80	80	133	107	30	467	467	400	173	333	187	0
Heliconius doris	413	547	320	393	213	200	200	133	67		547	307	387	253	280	160	160

On the prothorax, setae XD2 and D1 are subequal and seta XD2 is shorter than SD1. Seta SD1 is only a little cephalad of seta SD2 and, thus, almost directly dorsal. Seta L1 dorsad and slightly anterior to seta L2. On the meso- and metathorax, seta SD2 is less than a third the length of seta SD1.

On the first two anterior abdominal segments, seta SD1 is longer than seta D1. On the remaining abdominal segments, seta D1 is longer than seta SD1. Seta D2 is extremely small on all of the abdominal segments, being only 1/6 to 1/8 the length of seta D1. On the ninth abdominal segment, seta L1 is less than 1/10 the length of seta D1 and less than 1/4 the length of seta SD1. On abdominal segments 2-8, seta L1 is subequal or longer than seta D1.

The crochets of the ventral prolegs are longer and broader posteriorly than anteriorly. Sixteen crochets are present, of which eight are larger than the remainder. Thirteen crochets are present on the anal prolegs and comprise approximately 2/3 of a complete circle. The mesal crochets of the anal prolegs are larger.

Comparison with Other Heliconiinae of Trinidad.—*Agraulis vanillae* is remarkable among the Heliconiinae of Trinidad in the extreme shortness of seta D2 of abdominal segments 1-8, both in linear length and in relation to the other setae. Only in *Heliconius ricini* and *A. vanillae* are setae P2 and A3 subequal in length. On the prothorax, seta XD2 is subequal with seta D1. In *Heliconius isabella* seta XD2 is usually slightly longer than seta D1. Otherwise, in the remainder of the Heliconiinae dealt with in this paper, seta XD2 is shorter than seta D1. On the meso- and metathorax of *A. vanillae,* seta SD2 is less than ⅓ the length of seta SD1. In other Heliconiinae the length of seta SD2 is greater than ⅓ the length of seta SD1.

Dryadula phaetusa (Linnaeus)
(Text-figs. 4C, 5C; Tables 1-5)

Distinctive Characters.—Head dark colored.

Table 4. Length of Setae (in Microns) of First and Second Abdominal Segments in Heliconiinae.

Species	First									Second								
	D1	D2	SD1	L1	L2	L3	SV1	SV2	V1	D1	D2	SD1	L1	L2	L3	SV1	SV2	V1
Dione juno	280	133	293	187	200	0	147	0	53	240	120	267	240	200	0	147	53	40
Agraulis vanillae	253	25	280	227	173	0	107	0	53	253	25	280	240	200	0	180	93	53
Dryadula phaetusa	307	200	387	333	280	0	200	0	120	320	200	387	360	307	0	240	107	120
Dryas iulia	333	160	347	293	213	0	167	0	67	333	160	347	293	213	0	160	80	80
Philaethria dido	360	227	360	320	240	0	187	0	93	360	227	360	320	240	0	187	133	93
Heliconius isabella	347	267	360	253	200	0	133	0	120	347	267	360	253	200	0	133	120	40
Heliconius aliphera	560	200	453	333	267	213	240	0	93	533	187	453	320	280	200	227	147	93
Heliconius melpomene	347	200	280	160	167	0	100	0	53	280	120	333	227	200	0	187	80	53
Heliconius numata	267	147	267	200	187	0	107	0	67	253	137	253	213	213	0	107	67	67
Heliconius erato	360	120	253	267	200	0	147	0	67	360	120	253	267	240	0	133	93	67
Heliconius ricini	240	133	267	227	93	0	40	0	14	240	133	267	227	93	0	40	14	14
Heliconius sara	600	140	413	293	160	0	107	0	67	533	147	413	293	160	0	107	80	67
Heliconius wallacei	600	213	453	347	147	120	133	53	53	600	213	453	347	147	120	173	107	53
Heliconius doris	440	280	387	307	160	0	93	0	7	373	200	360	307	147	0	147	53	7

Hind margin of head irregular, shortly but broadly directed caudad in lateral part of head. Dark band on hind margin of head broad. Epicranial stem longer than frontal suture. Distance between ocelli 4 and 6 greater than the distance between 5 and 6 or between ocelli 4 and 5. Distance between ocelli 5 and 6 and between ocelli 4 and 5 subequal. Seta P2 further from the epicranial stem than seta P1. Distance between setae P1 and P2 greater than the distance between setae P1 and A3. Distance between setae P1 and A3 greater than the distance between setae P2 and L1 and also setae A3 and L1. Seta P2 is the longest seta on the head and, in decreasing lengths, setae P1, L1 and A3.

The lengths of the setae on the thorax and abdomen are relatively short in comparison to the size of the larvae. On the prothorax, seta D2 is equidistant from setae D1 and XD2. Seta SD1 is definitely anterior to seta SD2 and only a little dorsad. The lateral setae almost form a vertical line. On the meso- and metathorax, seta SD1 is longer than D1. On the first two anterior abdominal segments, seta SD1 is considerably longer than seta D1. On segments 3-8 inclusive, these setae are subequal. While the 17 crochets grade quite evenly in size from the anterior to the posterior part of the ventral proleg, three exceptionally stout and long crochets are noticable. The crochets are larger on the mesal than the lateral aspect, with the largest on the posterior part of the planta. The anal proleg has 17 crochets, with the larger crochets on the mesal and posterior part of the planta.

Comparison with Other Heliconiinae of Trinidad.—The width of the head of *Dryadula phaetusa* is only exceeded by that of *Philaethria dido*. The epicranial stem is longer than the frontal suture which separates *D. phaetusa* from all the species in the genus *Heliconius* except *H. aliphera*. *H. aliphera* is a very much smaller larva, with relatively much longer body setae and abdominal segments 1-8 with three lateral setae. Both *Philaethria dido* and *Dryas iulia* have light heads, in contrast to the dark head of *D. phaetusa*. In *P. dido* setae P1 and P2 are equidistant

TABLE 5. LENGTH OF SETAE (IN MICRONS) OF SIXTH AND NINTH ABDOMINAL SEGMENTS IN HELICONIINAE.

Species	Sixth									Ninth				
	D1	D2	SD1	L1	L2	L3	SV1	SV2	V1	D1	D2	SD1	L1	SV1
Dione juno	253	120	213	213	200	0	67	40	27	347	200	133	53	93
Agraulis vanillae	200	27	200	213	147	0	147	67	27	280	173	120	27	107
Dryadula phaetusa	360	147	360	320	267	0	173	53	53	267	147	120	120	147
Dryas iulia	267	133	293	267	240	0	160	67	40	307	167	147	93	120
Philaethria dido	320	227	360	258	240	0	80	53	13	333	227	173	133	160
Heliconius isabella	333	200	307	213	200	0	80	53	27	440	427	133	93	93
Heliconius aliphera	507	160	413	333	240	187	173	107	27	467	347	173	160	133
Heliconius melpomene	320	213	307	240	200	0	120	80	27	333	173	133	240	133
Heliconius numata	267	120	227	227	200	0	93	67	27	293	213	107	40	67
Heliconius erato	387	67	333	240	227	0	147	80	40	360	307	27	67	87
Heliconius ricini	240	120	267	227	133	0	53	40	40	293	227	93	93	27
Heliconius sara	507	133	360	267	173	0	93	40	13	333	413	200	147	80
Heliconius wallacei	507	173	400	293	213	120	133	67	53	440	360	160	93	107
Heliconius doris	400	200	480	267	160	0	40	93	27	373	307	173	93	40

from the epicranial stem, in *D. iulia* seta P1 is further from the epicranial stem than seta P2 and in *D. phaetusa* seta P2 is further from the epicranial stem than P1. *Dione juno* has seta SV2 present on the meso- and metathorax, a character otherwise present only in *H. doris*. *D. phaetusa* is the only species in which the distance between setae P1 and P2 is greater than the distance between setae P1 and A3. On the meso- and metathorax, seta SD1 is longer than seta D1. This character is shared with *D. juno* and *Heliconius numata*.

Dryas iulia (Fabricius)

(Text-figs. 4D, 5D; Tables 1-5)

Distinctive Characters.—Head light colored. Hind margin of head sinuate and curved cephalad above the sublateral area. A poorly defined sublateral rectilinear spot. The marginal band evenly broadened above the sublateral area. Epicranial stem longer than frontal suture. The distance between ocelli 5 and 6 equals the distance between ocelli 4 and 6. The distance between setae P1 to A3 is the same as the distance between setae P2 and L1. Seta P2 is the longest seta on the head and, in descending order of length, setae P1, L1 and A3. Seta P2 is approximately 25% closer to the epicranial stem than seta P1.

This is the only species of the Trinidad Heliconiinae in which a puncture has been found on the prothoracic plate. It is a small puncture anterior to seta D2 and equidistant between setae D1 and XD2. I am provisionally calling this puncture XDc. Seta SD1 is noticeably longer than seta XD2. Seta SD1 cephalad and dorsad of seta SD2. Seta L1 dorsad of seta L2 but only a little cephalad. On the meso- and metathorax, seta D2 is very much shorter than seta D1. Seta D2 is the same length on the first and second abdominal segments, but it is shorter on abdominal segments 3 to 8 inclusive. On the ninth abdominal segment, seta D2 is very slightly longer than on the first two abdominal segments.

Comparison with Other Heliconiinae of Trinidad—Dryas iulia is distinctive in having seta P2

closer to the epicranial stem than seta P1. In other Heliconiinae with the exception of *P. dido*, seta P1 is closer to the epicranial stem than seta P2. In *P. dido* the distance between the two setae and the epicranial stem is equal. The epicranial stem is longer than the frontal suture, which excludes *D. iulia* from all the species of *Heliconius* except *H. aliphera*, which has several other good distinctive characters. *A. vanillae* has the frontal suture longer than the epicranial stem. The presence of seta SV2 on the meso- and metathorax excludes *D. juno*. The greater distance between setae P1 and P2 than between setae P1 and A3 of the head excludes *D. phaetusa*. Seta D2 is ventrad of seta XD2 on the prothorax in *P. dido* but dorsad in *D. iulia*.

Philaethria dido (Clerck)
(Text-figs. 4E, 5E; Tables 1-5)

Distinctive Characters.—Head light colored. No notch present in sublateral area at hind margin of head, but a series of very small irregularities and a small projection present. Terminal hind band very narrow except in lateral and sublateral areas. Epicranial stem longer than frontal suture. Setae P1 and P2 equidistant from epicranial stem. Setae P1 and P2 subequal in length. Distance between setae P1 and A3 greater than the distance between setae P2 and L1. Distance between ocelli 4 and 5, 5 and 6, and 4 and 6 equidistant.

On the prothorax, seta XD2 is subequal in length with seta D1. Seta D2 is ventrad of seta XD2 and only slightly shorter. The subdorsal and lateral setae are nearly vertical. A tuberosity lies on the ventrum between the head and the prothoracic legs and is covered with multiple, very minute, setae. These setae spread irregularly below the SV pinaculum and along the lower, caudal part of the prothoracic leg. The cephalad and caudad parts of the base of the meso- and metathoracic legs, as well as the laterad parts below the SV pinaculum, are similarly vested. On the first two abdominal segments, setae D1 and SD1 are subequal and seta SD1 is slightly longer on the remaining abdominal segments except the ninth. Below seta L2 and above seta SV1 is a bulbous swelling on abdominal segments 1, 2, 7 and 8, variously clothed with very minute setae. This same setaceous swelling occurs on segments 3 to 6 inclusive, between seta L2 and the base of the proleg. On one side of abdominal segment 3 and on the opposite side of abdominal segment 8, an adventitious seta on pinaculum SD has appeared in one specimen. It is 40 microns in length. The ventral prolegs are unusual in that the 19 crochets appear to be of nearly uniform length. The anal proleg has 21 crochets, also of nearly uniform size, and they form over ¾ of a circle on the planta.

Comparison with Other Heliconiinae of Trinidad.—Philaethria dido is a large larva with the widest head of any of the Heliconiinae seen. It is the only species in which setae P1 and P2 are equidistant from the epicranial stem. The epicranial stem is very much longer than the frontal suture (see *D. iulia*). It is also the only species seen in which seta D2 of the prothorax is ventrad of seta XD2 and the only species with groups of ventral microscopic setae on protuberances of the integument of the body. The crochets of the ventral prolegs are unusual in their uniformity and to a lesser extent this is also true of the anal prolegs. The arc covered by the crochets of the anal prolegs is very large.

Heliconius isabella (Cramer)
(Text-figs. 4F, 5F; Tables 1-5)

Distinctive Characters.—Head dark colored with hind margin of head black with a small irregular and variable dark blotch on the sublateral margin in the vicinity of seta O3. Epicranial stem but slightly longer than frontal suture. Head setae acuminate. Seta P1 considerably nearer epicranial stem than seta P2 but slightly longer. Distance between setae P1 and A3 the same as the distance between setae P2 and L1. Seta L1 shorter than seta A3, and setae A1 and A2 subequal but shorter than seta A3. Adfrontal setae of the same length and relatively long in comparison with the remaining setae of the head and the width of the head. Distance between ocelli 4 and 6 greater than distance between either ocelli 4 and 5 or ocelli 5 and 6. The body setae are acuminate, concolorous and relatively long in comparison with the size of the larva and width of the head. Seta XD2 of the prothorax is longer than the combined length of the frontal suture and epicranial stem and in length is almost .9 the width of the head. Seta XD2 is longer than seta D1 and seta D2 is very little shorter than seta D1. Setae D1 and D2 of the meso- and metathorax are subequal. The subdorsal setae of the prothorax are vertical to each other, while the sublateral setae are almost horizontal. Seta L2 lies cephalad of the subdorsal setae and only a little dorsad of seta L1.

On the first two abdominal segments, seta SD1 is slightly longer than seta D1, but on segments 3-8 inclusive seta D1 is longer.

The crochets on the posterior parts of the planta are stouter and longer, but the 17 crochets are evenly graded from front to back. The

18 crochets of the anal prolegs are subequal and comprise nearly ¾ of the circle.

Comparison with Other Heliconiinae of Trinidad.— On the head in all species of *Heliconius* in Trinidad the epicranial stem is considerably shorter than the frontal suture, except in *Heliconius aliphera*. The epicranial stem is decidedly longer in *H. aliphera* and all but equal in *H. isabella*. In the other genera, with the exception of *Agraulis*, the epicranial stem is longer. The extreme shortness of seta D2 of abdominal segments 1-8 makes *Agraulis* distinctive. Only in *D. iulia*, *H. aliphera* and *H. isabella* is the distance between setae P1 and A3 and setae P2 and L1 equal. In *D. iulia* seta P2 is closer to the epicranial stem than seta P1. *H. aliphera* has several characters in common with *H. isabella*, including non-spatulate setae and relatively long setae, but may be readily separated by the light head and the presence of seta L3 on the abdominal segments 1-8.

Heliconius aliphera (Godart)
(Text-figs. 4G, 5G; Tables 1-5)

Distinctive Characters.—Head light colored with a fine dark line on posterior margin. A dark colored irregular spot in sublateral region of hind margin with a small V-shaped notch indented in the middle of the dark spot. Seta P1 nearer epicranial stem than seta P2. Distance between setae P1 and A3 the same as the distance between setae P2 and L1. Seta A3 longer than seta P2 and seta L1. Setae A1 and A2 subequal and much shorter than seta A3. Distance between ocelli 4 and 5, 5 and 6, and 4 and 6 subequal.

The body setae are concolorous, acuminate and often variously bent. They are relatively long in relation to the size of the larvae. For instance, seta XD2 of the prothorax is longer than the sum of the frontal suture and epicranial stem. Setae XD2, D2 and SD1 are subequal. Seta D1 is the longest and curves far over the head. Seta L1 is longer than seta SV1. On the meso- and metathorax, seta D1 and seta SD1 are subequal. Seta SD1 on the subdorsal pinaculum is almost directly dorsal of seta SD2. Seta L2 on the lateral pinaculum is similarly almost dorsal of seta L1.

On the abdominal segments 1-8, an additional seta, L3, is present. It is situated on the same pinaculum as seta L2 and cephalad and dorsad of seta L2. Seta L3 is approximately 4/5 the length of seta L2. It is longer than seta SV2 on abdominal segments 2-8 inclusive. Seta D1 of the abdomen is much longer than seta D2. On the first two abdominal segments, seta D1 is almost three times the length of seta D2 and on segments 3-8 more than three times. Seta SD1 of the ninth abdominal segment is larger than seta D2 of abdominal segments 3-8.

The ventral prolegs have 13 crochets, of which the three posterior crochets are larger. Barely half the circle on the planta of the anal prolegs is occupied by the 11 crochets.

Comparison with Other Heliconiinae of Trinidad.—The presence of seta L3 on the abdominal segments separates this species from all other Heliconiinae except *H. wallacei*. However, *H. wallacei* has an additional seta SV3, present on the prothorax, and another additional seta, SV2, present on the first abdominal segment. On the head in *H. aliphera* the frontal suture is longer than the epicranial stem. The head of *H. aliphera* is much wider in proportion to the size of the larva than the head of *H. wallacei*.

Heliconius melpomene (Linnaeus)
(Text-figs. 1, 2, 3A, B, 4H, 5H; Tables 1-5)

Distinctive Characters.—Head light colored. Dark terminal line on caudal edge of head. A V-shaped indentation in sublateral region of hind margin of head surrounded by a black spot. Frontal suture longer than epicranial stem. Distance between ocelli 4 and 6 greater than the distance between either ocelli 4 and 5 or ocelli 5 and 6. Seta P1 is longer than seta P2. Seta A3 is shorter than seta P2 but longer than seta L1. The length of seta XD2 of the prothorax is approximately half the width of the head and seta D1 is ⅔ of the width of the head. Seta SD1 is a little dorsad of seta SD2 and cephalad. Seta L2 is dorsad and cephalad of seta L1. The two lateral setae form an angle of approximately 25° with the horizontal. On the meso- and metathorax, seta D1 is a little longer than seta SD1.

Setae D1 and D2 of the first abdominal segment longer than the respective setae on the second abdominal segment. Seta SD1 of the second abdominal segment longer than seta D1.

The ventral prolegs have 14 crochets, of which the six posterior crochets are large. The circle of 12 crochets of the anal prolegs approximately 65% complete.

Comparison with Other Heliconiinae of Trinidad.—This species and *H. numata* appear to be closely related. However, on the head, the frontal suture and epicranial stem of *H. numata* are almost subequal, while in *H. melpomene* the epicranial stem is much shorter than the frontal suture. In general, the lengths of the setae of the head in *H. melpomene* are greater than in *H. numata*. This is particularly true of setae A3, L1, P1 and P2. On the prothorax seta XD2 of

H. melpomene is longer than seta D2 but the reverse is true of *H. numata*. Seta SD1 is shorter than seta XD2 in *H. melpomene* but longer in *H. numata*. On the meso- and metathorax, no large distinctions may be noted except that the relative sizes of the setae in relation to the width of the head are greater in *H. melpomene* than in *H. numata*. For instance, seta D1 is greater than half the width of the head in *H. melpomene* but less than half the width of the head in *H. numata*. Generally speaking, this same condition of greater relative length prevails on the abdomen. Finally, on the ninth abdominal segment, seta L1 in *H. melpomene* is longer than any other seta on this segment except seta D1, but in *H. numata* seta L1 is the shortest seta.

Heliconius numata (Cramer)
(Text-figs. 4I, 5I; Tables 1-5)

Distinctive Characters.—Head similar to *H. melpomene* (p. 106) except for distinctions noted. Seta XD2 of the prothorax approximately 2/5 the width of the head. Seta D2 longer than seta XD2. The position of the subdorsal and lateral setae similar to *H. melpomene*. On the meso- and metathorax, seta SD1 is subequal or longer than seta D1.

The abdominal segments are similar to *H. melpomene* except that on the ninth segment of *H. numata* seta L1 is minute.

The ventral prolegs with 16 crochets, of which 5 are distinctly larger than the remaining crochets. The anal prolegs have 10 crochets and complete but half a circle. In one specimen 12 crochets are present but still occupy only half a circle on the planta.

Comparison with Other Heliconiinae of Trinidad.—Refer to *H. melpomene* (p. 106) and *H. erato* (p. 107).

Heliconius erato (Linnaeus)
(Text-figs. 4J, 5J; Tables 1-5)

Distinctive Characters.—Head similar to *H. melpomene* except that the sum of the length of the frontal suture and epicranial stem is greater than the width of the head.

The length of seta XD2 of the prothorax is approximately 3/5 the width of the head. Seta SD1 longer than seta XD2. The relation of the setae of the subdorsal group is similar to *H. melpomene*, and the sublateral group is also similar, but seta L2 is possibly more caudad than in *H. melpomene*.

On the meso- and metathorax, seta SD2 in half (6) of the specimens seen was rudimentary. Only the base of the seta is evident. On the remaining specimens, the size of seta SD2 has varied from 40 to 130 microns.

On the first and second abdominal segments, seta D2 is ⅓ the length of seta D1 and on abdominal segments 3-8 a little more than 1/6. On abdominal segments 3-8, only seta V1 is shorter than seta D2. On the ninth abdominal segment, seta SD1 is unusually short.

Ventral prolegs with 15 crochets of which 6 are distinctly large. The crochets on the anal prolegs occupy approximately 70% of the circle on the planta and 5 crochets are distinctly large.

Comparison with Other Heliconiinae of Trinidad.—This species may be most easily separated from other Heliconiinae by the relative shortness of seta D2 of the abdomen in comparison with seta D1. On the first two abdominal segments, seta D2 is ⅓ the length of seta D1 and on segments 3-8 almost 1/6. In *A. vanillae*, where a similar condition persists, the difference is greater as seta D2 is 1/8 to 1/10 the length of seta D1, with the greatest differential in size occurring on the first two abdominal segments. The sum of the length of the frontal suture and the epicranial stem is greater than the width of the head in *H. erato* but less in *H. melpomene* and *H. numata*. In *H. erato* the length of seta XD2 in comparison with the width of the head is 3/5, of *H. melpomene* ½ and of *H. numata* usually less than 3/5.

Heliconius ricini (Linnaeus)
(Text-figs. 4K, 5K; Tables 1-5)

Distinctive Characters.—Head light colored. Head very narrow. Hind margin of head dark colored and a dark colored sublateral spot. A small point directed caudad from middle of sublateral spot. Frontal suture longer than epicranial stem. Distance between ocelli 4 and 6 very much greater than the distance between both ocelli 4 and 5 and ocelli 5 and 6. Distance from seta P1 to epicranial stem less than the distance from seta P2 to epicranial stem. Seta P1 longer than seta P2. Length of seta A3 subequal with seta P2. The distance between setae P1 and P2 subequal to the distance between setae P1 and A3.

On the prothorax, seta XD2 is subequal in length to the epicranial stem, or more than 7/10 the width of the head. Seta D1 is large in comparison to the size of the larva. Seta SD2 and L1 are short in comparison to the other setae. Seta L2 is absent. Seta SD1 cephalad of seta. SD2 but only slightly dorsad. On the meso- and metathorax, seta SD2 is relatively small in comparison with the other setae and seta SD1 is smaller than seta L1.

On abdominal segments 1-8, seta SD1 is sub-

equal or slightly longer than seta D1. Seta SV1 is very small and setae SV2 and V1 are minute.

The ventral prolegs have 15 crochets with a variable number of large-sized crochets, though usually 5 are of distinctive size. The anal prolegs comprise about 3/5 of a complete circle and have 12 crochets, of which 6 are larger than the remainder.

Comparison with Other Heliconiinae of Trinidad.—The larvae of this species are very small and have the narrowest head of any of the Heliconiinae of Trinidad. The ratio of the length of the setae to the width of the head is the largest of the Heliconiinae of Trinidad. The absence on the prothorax of seta L2 is singular. Seta L1 is short. For instance, seta L1 is approximately ⅓ the length of seta XD2. On abdominal segments 1-8 the shortness of the subventral and ventral setae is distinctive. This species seems most closely related to *H. erato*, but the absence of seta L2 on the prothorax, aside from other characters, makes the separation of the two larvae easy. Seta L2 of the prothorax is weak in *H. numata* and *H. melpomene* as well as in *D. juno* and *A. vanillae*.

Heliconius sara (Fabricius)
(Text-figs. 4L, 5L; Tables 1-5)

Distinctive Characters.—Head light colored. Hind margin of head dark colored with a dark colored sublateral spot with a small wedge-shaped notch. Frontal suture longer than epicranial stem. Distance between ocelli 4 and 6 greater than twice the distance between either ocelli 4 and 5 or ocelli 5 and 6. Distance between seta P1 and epicranial stem a little less than the distance between seta P2 and epicranial stem. Seta P2 longer than seta P1. Seta L1 shorter than seta A3. Distance between setae O2 and O3 more than twice the distance between seta O3 and hind margin of head.

On the prothorax, setae D1 and D2 are subequal. Seta SD1 is longer than seta XD2. Seta L1 is considerably longer than seta SD2. Subdorsal setae with seta SD1 a little more dorsad than seta SD2 and cephalad. Seta L2 directly dorsad of seta L1. Setae D1 and D2 of meso- and metathorax subequal and longer than seta D1 of prothorax. Seta SV1 of the same segments small in comparison with seta L1. Seta L1 subequal with seta SD1. Seta D1 approximately 4 times the length of seta D2 on abdominal segments 1-8. Conversely seta D2 is longer than seta D1 on the ninth abdominal segment.

The ventral prolegs have 16 crochets with 4 very large crochets on the posterior side of the planta. Approximately 3/5 of the planta of the anal prolegs are occupied by crochets, with the most posterior crochets the shortest.

Comparison with Other Heliconiinae of Trinidad.—This species may be separated from the previously mentioned *Heliconius* by seta P2 being longer than seta P1. In other species of Heliconiinae the distance between setae O2 and O3 is approximately twice or less than twice the distance between seta O3 and the hind margin of the head. In *H. sara* the distance between setae O2 and O3 is greater than twice the distance of seta O3 to the margin.

Only in this species and *H. isabella* is seta D1 very slightly longer than seta D2 on the prothorax. Only in this species and in *H. aliphera* is seta L1 greater in length than seta SD2. In *H. numata, erato, ricini* and *doris* the relationship of setae L1 and SD2 on the prothorax may be thought of as subequal. Only in *H. wallacei* and *A. vanillae* is seta D1 of the meso- and metathorax longer than seta D1 of the prothorax. In *D. iulia* and *H. doris* these setae are subequal. In the remainder of the Heliconiinae seta D1 of the prothorax is longer. *H. doris* may be separated by the presence of seta SV3 on the meso- and metathorax, and *H. wallacei* and *H. aliphera* by the presence of seta L3 on the abdominal segments. Seta P1 is further from the epicranial stem than seta P2 in *D. iulia*, whereas the reverse is true of *H. sara*. The small size of seta D2 on abdominal segments 3-8 distinguish *A. vanillae*.

Heliconius wallacei (Reakirt)
(Text-figs. 4M, 5M; Tables 1-5)

Distinctive Characters.—Head light colored with fine dark line on the posterior margin. A small, irregular, dark sublateral spot on hind margin. Frontal suture longer than epicranial stem. Distance between setae P1 and P2 less than the distance between setae A3 and L1. Seta P2 subequal in length or longer than seta P1. Seta A3 subequal in length with seta P2. Distance between ocelli 5 and 6 subequal with distance between ocelli 4 and 6.

On the prothorax, seta L1 is often weak and seta SV3 sometimes present. Seta SD1 cephalad and dorsad of seta SD2. Seta L1 dorsad of seta L2 but only a little cephalad. On the meso- and metathorax, setae D1 and D2 are subequal.

On the abdominal segments 1-8, seta D1 is longer than the sum of the frontal suture and epicranial stem. Seta L3 present on abdominal segments 1-8 inclusive. Seta SV2 present on first abdominal segment. Spiracle on the abdominal segment 8 subequal with spiracle on abdominal segment 7.

The ventral prolegs have 16 crochets with

three large crochets. The 12 crochets of the anal prolegs barely occupy half the planta.

Comparison with Other Heliconiinae of Trinidad.—The presence of seta L3 on abdominal segments 1-8 inclusive is only shared with *H. aliphera*. However, neither *H. aliphera* nor any other species of Heliconiinae of Trinidad have seta SV2 present on the first abdominal segment.

Heliconius doris (Linnaeus)
(Text-figs. 4N, 5N; Tables 1-5)

Distinctive Characters.—Head light colored. Posterior margin of head with a dark colored line starting at the caudal apex of the head, then evenly and gradually curved cephalad and recurved to margin of head in the vicinity of the sublateral region near seta O3. Frontal suture longer than epicranial stem. Distance of seta P2 to epicranial stem greater than the distance of seta P1 to epicranial stem. Distance between ocelli 5 and 6 subequal with distance between ocelli 4 and 6. Distance between setae P1 and P2 the same as the distance between setae A2 and L1. Seta P2 is longer than seta P1. Seta L1 shorter than seta A3.

On the prothorax seta XD2 is 7/10 as long as the width of the head and seta D1 nearly as long as the width of the head. Seta SD1 is cephalad and dorsad of seta SD2. Seta L2 nearly directly above seta L1. On the meso- and metathorax, setae D1 and SD1 are subequal with the respective setae on the prothorax. Seta SV2 is present on the meso- and metathorax and is subequal with seta SV1.

On the abdominal segments 1-8 inclusive, seta V1 is short, particularly when the length of the other abdominal segments is considered.

Ventral prolegs with 13 crochets evenly graduated from small to large. Anal prolegs with 15 crochets occupying approximately ¾ of the circle.

Comparison with Other Heliconiinae of Trinidad.—Seta XD2 of the prothorax is the longest in the unit length of any of the other species treated in this paper with the exception of *H. isabella*. Seta D1 of the prothorax is the longest seta in unit length of any species. For comparison with *D. juno* which it resembles in having seta SV2 on the meso- and metathorax, see under *D. juno* (p. 97).

Bibliography

Beebe, W.

1952. Introduction to the ecology of the Arima Valley, Trinidad, B. W. I. Zoologica, 37: 157-184.

Crumb, S. E.

1934. A classification of some noctuid larvae of the subfamily Hypeninae. Ent. Amer., 14: 133-196, 7 pls.

Dampf, A.

1910. Zur kenntnis gehausetragender lepidopterenlarven. Zool. Jb. (Suppl.), 12: 513-608, 54 figs.

Dyar, H. G.

1894. A classification of lepidopterous larvae. Ann. N. Y. Acad. Sci., 8: 194-232, 5 figs.

1896. Note on the head setae of lepidopterous larvae, with special reference to the appendages of *Perophira melsheimerii*. Journ. N. Y. Ent. Soc., 4: 92-93, 2 figs.

Ferris, G. F.

1943. The basic materials of the insect cranium. Microent., 8: 8-24, figs. 1-6.

Forbes, W. T. M.

1910. A structural study of some caterpillars. Ann. Ent. Soc. Amer., 3: 94-143, 143 figs.

1914. A structural study of some caterpillars. III. The somatic muscles. Ann. Ent. Soc. Amer., 7: 109-133, figs. 17-25.

1916. On certain caterpillar homologies. Journ. N. Y. Ent. Soc., 24: 137-142, 1 fig.

1923. The Lepidoptera of New York and neighboring states Mem. Cornell Univ. Expr. Sta., 68: 1-729, 439 figs.

Fracker, S. B.

1915. The classification of lepidopterous larvae. Ill. Biol. Monogr., 2: 1-169, 5 figs.

Garman, H.

1921. Some neglected setae of lepidopterous larvae. Ann. Ent. Soc. Amer., 14: 145-149, 13 figs.

Gerasimov, A. M.

1935. Zur frage der Homodynamie der borsten von schmetterlings-raupen. Zool. Anz., 112: 177-194, 8 figs.

1937. Bestimmungstabelle der familien von schmettsraupen. Stett. Ent. Zeit., 98: 281-300, 18 figs.

1952. Fauna of the U. S. S. R. Vol. 1: 1-338. Acad. Sci. U. S. S. R., Moscow (in Russian).

Heinrich, C.

1916. On the taxonomic value of some larval characters in the lepidoptera. Proc. Ent. Soc. Wash., 18: 154-164, 5 figs.

1918. On the lepidopterous genus *Opostega* and its larval affinities. Proc. Ent. Soc. Wash., 20: 20-38, 34 figs.

1921. Some lepidoptera likely to be confused with the pink bollworm. Journ. Agric. Res., 20: 807-836, 17 pls.

HINTON, H. E.

1946. On the homology and nomenclature of the setae of lepidopterous larvae with some notes on the phylogeny of the lepidoptera. Trans. Roy. Ent. Soc. Lond., 97: 1-37, 24 figs.

1947. The dorsal cranial areas of caterpillars. Ann. Mag. Nat. Hist., (11) 14: 843-852, 6 figs.

1952. The structure of the larval prolegs of the lepidoptera and their value in the classification of the major groups. Lep. News, 6: 1-6, 1 pl.

KAYE, W. J.

1921. A catalogue of the Trinidad Lepidoptera Rhopalocera. Mem. Dept. Agric., Trinidad and Tobago, No. 2: xii + 163, 1 pl.

MCGUFFIN, W. C.

1958. Larvae of the nearctic Larentiinae (Lepidoptera; Geometridae). Can. Ent., XC, Suppl. 8: 1-104, 216 figs.

MICHENER, C. D.

1942a. A generic revision of the Heliconiinae (Lepidoptera Nymphalidae). Amer. Mus. Novit., 1197: 1-8, 17 figs.

1942b. A review of the subspecies of *Agraulis vanillae* (Linnaeus). Lepidoptera: Nymphalidae. Amer. Mus. Novit., 1215: 1-7.

MÜLLER, W.

1886. Sudamerikanisher nymphalidenraupen. Versuch eines naturlichen systems der nymphaliden. Zool. Jb. (Syst.), 1: 417-678, 4 pls.

PETERSON, A.

1948. Larvae of Insects. I. Lepidoptera and Plant Infesting Hymenoptera: 1-315, 74 pl. Edwards Bros., Ann Arbor, Mich.

QUAIL, A.

1904. On the tubercles of thorax and abdomen in the first larval stage of Lepidoptera. Entomologist, 37: 269-272, 1 pl.

RIPLEY, L. B.

1923. The external morphology and postembryology of noctuid larvae. Ill. Biol. Monogr., 8: 1-169, 61 figs.

SCHIERBEEK, A.

1917. On the setal pattern of caterpillars and pupae. ii + 157 pp., 5 pls., Leiden.

SEITZ, A.

1913. Macrolepidoptera of the world. Vol. V: 375-402, pls. 72-84, Stuttgart.

SNODGRASS, R. E.

1935. Principles of Insect Morphology. ix + 667 pp. McGraw-Hill Book Co., N. Y.

1947. The insect cranium and the epicranial suture. Smith. Misc. Coll., 107, No. 7: 1-52, 15 figs.

TSOU, T. H.

1914. Homology of the body setae of some lepidopterous larvae. Trans. Amer. Micr. Soc., 33: 223-260, 4 pls.